Use of Efficiency Gap in Analyzing Partisan Gerrymandering

Report for State of Wisconsin, *Whitford v. Nichol*

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I. Introduction

My name is Nicholas Goedert, and I am currently a Visiting Assistant Professor of Government and Law at Lafayette College in Easton, Pennsylvania. I teach classes in American electoral politics, voter behavior, the United States Congress, constitutional law, and representation theory.

I have been retained by the defendants in this lawsuit to provide expert opinions in the case titled above. More specifically, I have been asked to offer opinions on using the efficiency gap to measure partisan gerrymandering as done by the plaintiffs' experts Professor Kenneth Mayer and Professor Simon Jackman.

II. Qualifications and compensation

I received a Ph.D. in Politics from Princeton University in 2012, where I completed a dissertation on congressional redistricting, and my graduate training included courses in quantitative methods and statistics. I received my undergraduate degree in Social Studies from Harvard University in 2001, and a J.D. from Georgetown University Law Center in 2006, where I specialized in election law. My curriculum vitae is attached to this report.

All my publications that I have authored or published appear in my curriculum vitae. Those publications include peer-reviewed journals such as: *The American Journal of Political Science*, *State Politics and Policy Quarterly*, *PS: Political Science and Politics*, *Election Law Journal*, and *Research and Politics.*

I have published, or have forthcoming publications, specifically on the effects of districting methods on competition in congressional elections in *State Politics and Policy Quarterly* and *Election Law Journal*, and on the effects of geographic bias in congressional

districting in *Research and Politics* and in The Monkey Cage political science blog at *The Washington Post.*

I am being compensated at a rate of $175 per hour.

III. Summary

1.) Despite claims in the plaintiffs' complaint, a large efficiency gap does not necessarily imply an unbalanced map. Instead, a large efficiency gap implies deviation from a predetermined seats/votes curve representing "hyper-proportionate" or "hyper-responsive" representation. Thus, using an efficiency gap standard creates the same constitutional issues as the proportional representation standard the Court has previously rejected. Moreover, requiring adherence to a specific seats/votes curve may discourage legislatures from drawing maps that would fulfill normatively desirable objectives, such as maximizing competitive elections or achieving proportional representation, but do not conform to this expected seats/votes curve. (Section IV)

2.) The plaintiffs' complaint alleges that an efficiency gap of 7% in a single election is sufficient for presumptive unconstitutionality. But evidence in both the academic literature and the plaintiffs' expert report show that efficiency gaps of the size proposed in the complaint are highly unstable and not particularly informative of future or durable gaps. In fact, as many as half of all maps that exceed this threshold in one election during a decade will be biased in favor of the opposite party in another election during the same decade. And even those few maps that are significantly and durably biased in favor of one party are mostly not even drawn with clear partisan intent. (Section V)

3.) The plaintiffs' complaint lacks a crucial addition "sensitivity testing" prong suggested in the academic literature. Without an additional test of durability, a majority of single election results exceeding the predetermined threshold would be false positives, because they are either not drawn with partisan motivation, or they would be biased in favor of the opposite party in another election during the same decade. The test of durability in Jackman's report is somewhat unclear and arbitrarily conditions durability on the results of small handful of elections. Additionally, even including the sensitivity testing prong as detailed in the literature would be potentially constitutionally problematic. (Section VI)

4.) The expert report of Mayer purports to show that an alternate map (i.e. the Demonstration Plan) could have been drawn with much lower efficiency gap in 2012. However, the map created by Mayer was generated based on significant information, the overall 2012 electoral environment, that was unknowable to the legislature at the time the map needed to be drawn. The Demonstration Plan is also deliberately drawn to exclude information that legislators would likely incorporate into their districting decisions, in the form of incumbency and anticipated uncontested races. Additionally, the report does not provide data on what bias we should expect to observe under the Demonstration Plan given the range of possible future election results. (Section VII)

5.) Any judgment about the partisan motivation behind pro-Republican bias in a map should be made in the context of bias due to the asymmetric geographic dispersion of partisans. This dispersion has generated Republican bias in many states' maps across the nation over the last few decades, growing in the most recent election cycles, as observed in both the academic literature and the plaintiffs' expert report. It has also generated Republican bias in two different non-partisan maps drawn in Wisconsin, in a few cases in excess of

the bias observed in the most recent election cycle under the Republican-drawn map. Evidence of this bias is also observed in an analysis of the distribution of Wisconsin wards. (Section VIII)

IV. General Properties of Efficiency Gap

A. Efficiency gap demands codification of a specific relationship of seats to votes that amounts to hyper-proportional representation

Efficiency gap is defined both by the plaintiffs and in the academic literature as the ratio of one major party's wasted votes to the other major party's wasted votes. In a single-member, majority rule district, all votes for a losing candidate are wasted, and votes for a winning candidate in excess of the 50% threshold needed for victory are also wasted. Thus in all individual seat elections with two candidates, exactly half of the votes are counted as wasted, with the losing candidate accounting for a greater share of wasted vote the closer the election is.

Although a precise calculation of efficiency gap across a collection of races requires knowing the total number of votes cast for each major party candidate in each race, this can be simplified into a linear seats/votes curve with zero bias and a slope of 2 if one assumes equal turnout in all districts. (McGhee 2014, p. 80). This simplification is used in the Stephanopoulos and McGhee article originally advocating for efficiency gap as a standard for adjudicating partisan gerrymanders (p. 853), as well as the historical analysis in the plaintiffs' expert report by Jackman (section 6.1, p. 18). I concur that this shortcut is an appropriate and useful summary measure of efficiency gap and also use it in subsequent examples in this report. However, the fact that efficiency gap under basic assumptions simplifies to a single linear seats/votes curve also displays its drawbacks for use as a standard for a Court to judge the constitutionality of a map.

The Supreme Court has stated on multiple occasions that the Constitution does not guarantee a right to proportional representation of any particular group, a sentiment echoed in both the majority and dissent in *Vieth* (*Vieth v. Jubelirer*, 541 U.S. at 288; *Vieth v. Jubelirer* 541 U.S. at 338 (Stevens, J., dissenting); *Davis v. Bandemer*, 478 U.S. at 111). And the Court has additionally been wary of adopting a standard for partisan gerrymanders that would amount to

proportional representation (*Davis v. Bandemer* 478 U.S. at 155). Yet the efficiency gap test would codify a very specific translation of seats to votes that is essentially "hyper-proportional" representation. Every 1 percentage point increase in vote would be expected to translate into a 2 percentage point increase in seats in order for a map to be measured as fair.

This formula does have the advantage of roughly conforming with the observed average seat/votes curve in historical U.S. congressional and legislative elections (see e.g. Tufte 1973, Goedert 2014). But this correlation is coincidental and not connected to the theory behind EG. Moreover, the correlation is not guaranteed to hold up over time, especially as populations become more polarized in their partisanship. Codifying this relationship between seats and votes would constrain states wishing to reform their voting or districting systems. There are several ways in which states might wish to draw districts for normatively good reasons that would be seen as highly biased, and thus potentially unconstitutional, when measured under EG, especially when taking into account unpredictable electoral tides.

B.) An efficiency gap standard may discourage drawing of competitive districts

Because they are highly sensitive to tides, implementing an efficiency gap standard may discourage legislatures from drawing maps with too many competitive seats. During a wave election favoring either party, competitive districts may all fall in one direction, causing an extreme EG measurement favoring that party despite the balanced intent behind drawing these districts.

For example, suppose a state with 20 districts contained a roughly even number of Democrats and Republicans, but that the state's mapmakers chose to draw half these districts to be evenly balanced, and half to clearly favor one party. So ten districts are drawn to be 50% Democratic and 50% Republican, while five districts are drawn to be overwhelmingly (e.g 75%) Democratic, while the last five districts are drawn to be similarly overwhelmingly Republican.

Now, suppose in one election the Democrats win 55% of the two-party vote overall (a wave slightly smaller than 2008 at the national congressional level), and that this gain in vote share is spread approximately evenly across the state. Each party would still win the five seats that were drawn to be safe for them, but the Democrats would also win all ten seats drawn to be most competitive. Thus, the Democrats would win 75% of the seats with 55% of the vote. Efficiency Gap would prescribe that a fair map would assign Democrats only 60% of the seats with this vote share, and so this map would be measured as 15% biased in favor of the Democrats. Of course, if Republicans won 55% of the vote, evenly spread across the state, the map would have a 15% Republican bias under efficiency gap. But the test suggested by the plaintiffs asks the Court to evaluate the constitutionality of a map based only on the bias measured in one election.

Moreover, during a time in which several states are moving to reform their redistricting process and incorporating the value of political competition into reform considerations, we do observe real maps that efficiency gap would judge too sensitive to shifting tides on both sides. For example, Arizona congressional districts are drawn by a nonpartisan commission that since 2001 is required by state law to try to drawn competitive districts when possible. After the 2000 Census, this commission drew half the state's 8 districts in a balance within 6% of the national average presidential vote share throughout the decade (as measured by Cook's PVI, a measure of the partisanship of congressional districts relative to the nation based on recent presidential election results). The result has been a great deal of competition and partisan turnover since 2002, but large fluctuations in efficiency gap. As shown in Table 1 below, the map had an efficiency gap of 14% in favor of Republicans in 2002, but this switched signs twice during the decade, favoring Democrats in 2006 and 2008, and switching back to Republicans in 2010. Under a new, but still nonpartisan map, this switched back a third time in 2012, with an efficiency gap favoring Democrats of 14%. This Commission has at various times been accused

by both parties of acting with partisan intent; efficiency gaps may yield spurious evidence of partisan bias even when motivated only by desire to enhance competition.

Table 1. Arizona Congressional Results, 2002-2012

Year	GOP seats	GOP Vote	Eff. Gap
2002	75.0%	55.7%	13.6%
2004	75.0%	60.9%	3.1%
2006	50.0%	52.1%	-4.2%
2008	37.5%	46.4%	-5.4%
2010	62.5%	53.1%	6.2%
2012	44.4%	54.3%	-14.1%

C.) An efficiency gap standard may discourages enactment of proportional representation.

While the Court has held that the Constitutional does not *require* it, proportional representation of political parties *is* a permissible goal that a state may choose to adopt (*Vieth v. Jubelirer*, 541 U.S. 338 (Stevens, J., dissenting); *Gaffney v. Cummings*, 412 U.S. at 754). But because the efficiency gap requires a 2:1 "hyper-proportional" relationship between seats and votes, it may also discourage the drawing of districts to achieve 1:1 proportional representation. For example, suppose a state's partisan identification is 60% Democrat and 40% Republican and has 20 districts. The state wishes to achieve fair proportional representation, and so draws 12 districts to be 100% Democratic and 8 districts to be 100% Republican. If Democrats do get 60% of the vote, they will win 60% of seats, but EG requires that a fair map would award 70% of seats to Democrats in this scenario. Thus, the map that was both proportional and virtually guaranteed to yield a Democratic majority would be measured by EG to be biased by 10% in favor of Republicans.

Note that the above hypothetical would create a map completely resistant to shifts in partisan tides, which may be normatively undesirable. But one might also imagine a map drawn

to achieve proportional representation and still be responsive to change. For example, imagine a state with 20 districts, evenly balanced between Democrats and Republicans in an election without tides favoring either party. Suppose District 1 is drawn to be 97.5% Democratic, and then each subsequent district is drawn to be 5% more Republican than the last. So District 2 is 92.5% Democratic; District 10 is 52.5% Democratic; District 11 is 47.5% Democratic; and District 20 is 2.5% Democratic and 97.5% Republican (see Table 2 below).

Table 2. Efficiency Gap Under Hypothetical Map Designed to Create Proportional Representation

District	Partisan Baseline (% Dem under 50/50 Statewide Party Split)	Winning Party under statewide vote: 50% Dem	55% Dem	60% Dem
1	97.5%	D	D	D
2	92.5%	D	D	D
3	87.5%	D	D	D
4	82.5%	D	D	D
5	77.5%	D	D	D
6	72.5%	D	D	D
7	67.5%	D	D	D
8	62.5%	D	D	D
9	57.5%	D	D	D
10	52.5%	D	D	D
11	47.5%	R	D	D
12	42.5%	R	R	D
13	37.5%	R	R	R
14	32.5%	R	R	R
15	27.5%	R	R	R
16	22.5%	R	R	R
17	17.5%	R	R	R
18	12.5%	R	R	R
19	7.5%	R	R	R
20	2.5%	R	R	R
Statewide Total	50%	10 D/10 R	11 D/9 R	12 D/8 R
Efficiency Gap		0%	-5%	-10%

Under an election that is split 50/50 in the vote, Democrats will likely win districts 1 though 10, and Republicans districts 11 through 20, yielding no net efficiency gap. But if the balance of the electorate changes, either permanently or through a single wave election, the seat

share for each party will likely shift proportionately, create efficiency gap bias. If Democrats win 60% of the vote statewide, they will now win districts 1 though 12, or 60% of the seats. Yet efficiency gap prescribes that a party should win 70% of the seats with this vote share, so the map would be judged as 10% biased (and thus presumptively unconstitutional) in favor of the *Republicans*.

We can also observe anecdotal evidence of large efficiency gaps in real maps designed to draw safe and roughly proportional districts by bipartisan agreement. In the 2000's decade, Democrats controlled all branches of state government in California, but instead of crafting an aggressively partisan congressional map, worked closely with Republicans in the legislature to draw districts that would protect incumbents of both parties and thus create almost entirely safe seats. In 2008, Democrats won 64% of the congressional seats in California with approximately 64% of the statewide vote share. But efficiency gap would judge this map to be biased in favor of Republicans by 14% that year, and thus presumptively unconstitutional were this the first year after redistricting, despite being drawn under Democratic control, and passed by large majorities of both parties in the legislature.

Contrary to the plaintiffs' assertion in complaint paragraph 51, a large efficiency gap does not imply a map is unbalanced, as shown in the above examples. Even a "balanced" map can show extreme EG bias under some (or even all) electoral tides conditions and varying normative definitions of balance.

V. Historical Instability and Fluctuations in Efficiency Gap

A. Past results demonstrate enormous instability even within a given decade and sensitivity to very realistic partisan tides

The plaintiffs' complaint alleges that a districting plan should be considered presumptively unconstitutional if an efficiency gap of 7% is observed in a single election (paragraph 86) (though they also propose that the Court could declare the specific Wisconsin plan unconstitutional without setting an exact threshold). In doing so, they rely on the Jackman report (p. 56), and also cite research by Stephanopoulos & McGhee (2015) suggesting an 8% threshold for state house plans. The complaint alleges that "where the efficiency gap is large and much greater than the historical norm…intent to systematically disadvantage voters based on their political beliefs can be inferred by the severity of the gerrymander alone" (Plaintiffs' complaint, paragraph 6). Yet both the academic research and data presented by the plaintiffs' expert show that such intent cannot be inferred.

Indeed, as both the Jackman report and the Stephanopoulos & McGhee article comprehend, merely observing a given threshold gap in a single election is not very informative as to the gap that we might expect over the lifetime of a plan. Indeed, Jackman acknowledges that "Conditional on observing an election with $EG > .07$, there is a 45% chance that *under the same plan* we will observe $EG < 0$." (p. 56). In other words, about half of all plans over the past 40 years that crossed the threshold for presumptive unconstitutionality in one election are also biased in favor of the opposing party in at least one election during the same decade. As measured by Stephanopoulos and McGhee, this is also true of 5 out of 14 state house plans crossed their 8% threshold for Republican bias during the 2000's decade (Stephanopoulos and McGhee 2015, p. 882).

And several iconic examples of Republican gerrymanders did not even display a consistent efficiency gap through the decade. Perhaps most famously, the Pennsylvania congressional map drawn by Republicans and upheld in *Vieth v. Jubilirer* elected Republicans to just 7 of 19 seats based on about 44% of the major-party in 2008, resulting in an efficiency gap bias EG bias in favor of *Democrats* in 2008. Similar backfires occurred the same year in other states districted by Republicans such as Virginia and Ohio. By the estimates of Stephanopoulos and McGhee, 18 of the 23 congressional or state legislative plans that were alleged in suits prior to 2010 to be unlawful partisan gerrymanders were actually measured as being biased in both directions during the decade of their existence. And the *only* plans definitively biased in favor of Republicans occurred in Florida in the 2000's, a state that served as an iconic example of bias created from geographic dispersion rather than intentional gerrymander, as discussed in Section VIII below.

B. Very few plans are unambiguous as to sign, and they are usually not even partisan gerrymanders

Indeed, it is rare that a map is clearly is biased in favor or one party or another over the course of an entire decade, and the few plans that are clearly biased are not even necessarily partisan gerrymanders. On p. 53, the Jackman report mentions that only 12% (17 out of 141) of state legislative plans analyzed over four decades are unambiguous as to the direction of their bias, based on his measurement of confidence over imputations in uncontested races; these 17 plans are listed on Table 1 on p. 55. 16 of the 17 plans are biased in favor of the Republicans, suggesting natural geographic bias favoring Republicans discussed further below. But more importantly, most of these plans are *not* partisan gerrymanders. Of the 16 most Republican plans, only six or seven would plausibly be called partisan gerrymanders from the standpoint of partisan control of the districting process. Instead, they include such plans as the New York

legislature in every decade (usually under split control), an example used by Rodden and Chen to demonstrate asymmetric geography. Additionally, the short list also includes the Wisconsin map from 2001-2010 that was drawn by a court. So a durable bias in favor of Republicans is not even a sign of deliberate partisan intent in even the strongest anecdotal evidence.

VI. Testing the Aensitivity and Durability of Efficiency Gap

A. The plaintiffs' complaint does not include a crucial second part to the empirical test for presumptive unconstitutionality, sensitivity testing for future results

Stephanopoulos and McGhee also allow that "most redistricting plans are volatile enough that their precise consequences cannot be forecast with great accuracy. Specifically, a plan's efficiency gap in one election is a relatively weak predictor of its gap in the next election" (p. 864). Therefore, observing a certain gap in one election is *not* a sufficient test of presumptive unconstitutionality for Stephanopoulos and McGhee. Instead, they suggest that for a map to be presumed unconstitutional, it should not only reach a specified level of bias in a particular election, but also be very unlikely to switch signs in bias over the foreseeable elections in the future (p. 889). "(W)e recommend setting the bar at…8 percent or state house plans, *with the further proviso that sensitivity testing show that the efficiency gaps are unlikely to hit zero over the plans' lifetime*." (p. 887, emphasis mine).

Stephanopoulos and McGhee evaluate the second criteria through "sensitivity testing", shifting the actual election results by 7.5% in each direction for congressional plans, and 5.5% in each direction for legislative plans, and calculating the gaps for each shift (p. 864). Under this second test, most of the instances of efficiency gaps beyond the initial threshold would *not* be judged presumptively unconstitutional because the simulated gap is too unstable.

The plaintiffs' complaint includes no such second part to the test for presumptive unconstitutionality. Without this second part to the test, almost any plan could be judged

presumptively unconstitutional under some election conditions. Thus, the EG standard could come down to a pure subjective evaluation of partisan intent, combined with a well-time fluke election result.

B. Jackman's report contains testing of robustness of EG measures over time, but it is unclear how these are to be incorporated into the test

In place of an explicit sensitivity testing prong to be applied to each map at issue, the Jackman report implies that sensitivity testing though modeling a future range of possible election results is unnecessary because efficiency gaps of a certain magnitude are historically unlikely to switch signs when observed in the first elections after redistricting. But conditioning one's observations only on particular election results is rather arbitrary, and in this case, likely biases toward a finding of EG durability. This is because among the notable national "wave elections" during in the period from 1972-2014 (e.g. 1974, 1994, 2008, 2010), none occurred immediately following a redistricting year. Instead, most post-redistricting elections occurred in years of relative partisan balance at the legislative level. The lack of notable wave elections among those picked to condition on is probably coincidental, but likely does result in less instability than if the durability of EG measurements were observed after such a wave election. There is no guarantee that in the future, a wave election will not occur immediately after redistricting, and thus applying this standard to future cycles would inappropriately imply durability. A more accurate test would be how often a gap of a certain magnitude in *any* cycle implied consistency across an entire decade. As previously noted, this test gives us much less confidence about the durability of a single EG measurement.

C. Even the Stephanopoulos & McGhee sensitivity testing is a flawed way to judge constitutionality after a single election

But even the sensitive test as proposed by Stephanopoulos and McGhee is problematic. The Stephanopoulos and McGhee sensitivity testing prong is an important acknowledgement of the fluctuations observed in efficiency gap as electoral tides shift. Yet as the authors themselves concede, this test involves simulating future election results assuming a hypothetical uniform swing across all districts, a method found problematic in evaluations of partisan bias by Justice Kennedy in *LULAC v. Perry* (548 U.S. at 420). The authors justify the use of this method nevertheless by saying it is not used to calculate the point estimate of bias, only the uncertainty. But given the overwhelming number of false positives generated from reliance on the point estimate alone, this underestimates the importance of the sensitivity testing prong in the final determination of constitutionality.

Additionally, Stephanopoulos and McGhee argue that their sensitivity test involves hypothetical swings much smaller than needed to evaluate the symmetry of partisan bias, as they only swing results in either direction 7.5 percentage points in the case of congressional maps, and 5.5 points in the case of state legislative maps. Yet this shift may not be sufficient to simulate the plausible range of election results than may be observed with a decade. For example, the Republican share of the two-party aggregated national popular vote in congressional elections jumped from 44.5% in 2008 to 53.5% in 2010 (a nine point swing). So shifting the 2008 national result 7.5 points in both directions would have been insufficient to encompass the actual national result two years later. And within a single state, where small variations in incumbency and candidate choice may have greater impact on aggregated results, fluctuations across elections could be even larger.

VII. Discussion of Mayer Demonstration Plan and Data Imputation

Both the expert reports of Jackman and Mayer rely on imputing votes for counterfactual electoral situations. Most frequently, this is done in case of past election results where a candidate was running without major party opposition. When measuring the bias in a map from an academic standpoint, imputing vote share in unopposed races seems entirely appropriate, as do the specific methods used in both reports to make these imputations. However, this seems more problematic in the context of a legal challenge to a map asserting that a particular individual's constitutional rights have been violated. Specifically, if an individual votes for party A in an election with no major party opposition, it would be curious to allege that individual's right to political representation has been violated because they hypothetically may have voted for party B had a different district been drawn to induce party B to run a candidate. And it would be even more curious to blame that hypothetical lack of representation on the mapmaker as opposed to the party that chose to run no candidate in the district or the voter who nevertheless voted for the opposing party.

But the most concerning imputation decisions come in the case of the demonstration plan presented in the Mayer expert report. The plaintiffs claim that this demonstration plan shows that these alternate districts would have produced an efficiency gap bias of only 2%. However, this calculation is made not by assuming that any of the existing candidates in the 2012 elections ran in new districts, but by imputing a baseline partisanship for each new district, and adjusting this baseline for 2012 electoral conditions, assuming all districts are contested by both major parties and no districts are contested by incumbents (Mayer report, p. 31 and 45). As with the previous discussion of imputation of votes in uncontested races, this technique seems appropriate in studying the baseline characteristics of a map for academic purposes. But legislators will of course not draw a map assuming that no incumbents will run, or that all races will be contested. Instead, the actual mapmakers will probably have a fair idea of which districts will be contested

by which incumbents, and which districts are likely to be uncontested. So while it may have been possible to draw a map with a low baseline bias in partisanship absent the effects of incumbency or uncontested elections, this would not be the most accurate data that legislators would be able to access in terms of predicting actual election outcomes.

Moreover, the Mayer plan sets out to predict bias using the actual 2012 election outcome, a narrow statewide victory for the Democrats in terms of aggregated vote totals. But this particular outcome in unknowable to mapmakers at the time maps must be drawn. Mayer points out that this outcome was close to the projection produced by Gaddie or district baseline partisanship prior to the election. But this outcome (where the statewide vote in 2012 closely matched baseline partisanship) was mostly coincidental. It could just as easily have happened that this cycle produced a wave election in favor of either the Democrats or the Republicans, strongly deviating from all baseline estimates. Mayer provides no estimates for the efficiency gap of the demonstration plan under the range of plausible election outcomes facing legislators at the time they were drawing the map.

VIII. Geographical Bias in Wisconsin and the Nation

A. Bias from Geographic Dispersion of Partisan: General Arguments

The test proposed in the plaintiffs' complaint allows that a map exceeding the predetermined threshold for bias may rebut the presumption of unconstitutionality by showing such bias is "inevitable given the state's underlying political geography" (paragraph 84). The plaintiffs propose to show that such bias should not be deemed "inevitable" by presenting one specific demonstration plan that, through a series of imputations, would have displayed much lower bias in 2012.

But creating a hypothetical plan with lower bias after knowing the result of a particular election is not a reasonable way to evaluate the propensity of a state's underlying geography to

generate bias, or ability of a nonpartisan actor to anticipate a particular election result prior to the election happening. Instead, evaluation of whether political geography substantially contributed to bias is more appropriately measured by any of several other techniques, including: (1) comparing bias observed in Wisconsin to other comparable states during the same time period; (2) comparing the current map in Wisconsin to previous maps in the same state drawn without partisan motivation; and (3) simulating nonpartisan districts. Any of these methods would suggest that the asymmetric geographic dispersion of partisans makes it much easier and more natural for even a nonpartisan or bipartisan regime to draw a map biased in favor of Republicans in Wisconsin, particularly when the statewide electorate is evenly balanced.

This report does not attempt to simulate nonpartisan districts beyond a simple analysis of ward distribution, but recent research suggests such simulations create substantial Republican bias in state legislatures in several states with similar political geography. Chen and Rodden (2013) show how recent political geography generates substantial Republican bias in legislative elections in states across the nation, even when districts are drawn randomly, while still incorporating values of contiguity and compactness. Chen and Rodden use the geography of Florida as a detailed example, with several very compact urban areas of very concentrated Democratic strength, surrounded by much more sprawling regions of more modest Republican advantage. Yet they simulate random state legislative district in more than 15 additional state (Wisconsin not among the states where data for such simulation was available), and find "that Florida is not an outlier…average bias in favor of Republicans is substantial – surpassing 5% of state legislative seats – around half the states for which simulations were possible" (Chen & Rodden 2013, p. 262).

B. Evidence of growing geographic in nation as a whole

Under multiple different measures, overall bias has been found to be shifting increasingly toward Republicans across the nation in recent decades. Using a very simple methodology, I also find that geography generated an average of 7% bias in the 2012 congressional elections in states even controlling for the partisanship of districting (Goedert 2014, p. 4). And the Jackman report notes that while the overall average efficiency gap in all state house elections from 1972 to 2014 is very close to zero, the average was significantly more likely to be biased in favor of Democrats in 1970s and 1980s, and more likely to be biased toward Republicans in later decades, especially the 2010s. On p. 44, the Jackman report states that while 5 of the 10 most pro-Republican efficiency gap estimates from the past 40 years were observed in the two most recent cycles (none being in Wisconson), *all* of the 10 most pro-Democratic estimates occurred prior to 2002.

Additionally, Stephanopoulos and McGhee find that Republican bias in the average state house plan has gradually grown from -1.5% in the 1970s and 1980's to 2.1% in the 2000's, peaking at 3.7% in 2012 (Stephanopoulos & McGhee 2015, p. 871-2; graph on p. 873). While Stephanopoulos and McGhee attribute much of this growth in prior decades to "favorable trends in voters' residential patterns", they also claim the "spike" in 2012 was caused by more extreme partisan gerrymanders. Nevertheless, this overall bias in favor of Republicans is largely a continuation of a recent trend in political geography. Regardless of how it is measured, geography appears to play a potentially significant role in biasing election results. If the Court is insistent on using efficiency gap as a standard to measure partisan intent, it would seem clear that an adjustment for geography, which is not the result of such intent, should be made in lieu of a predetermined hard-and-fast threshold.

C. Evidence of asymmetric bias in historical Jackman data

On p. 60-61 of his report, Jackman describes Republican bias as more durable and certain than Democratic bias of the same magnitude. This is apparently noted to suggest that Republican bias observed in a single election should be viewed by the Court as especially dangerous dues to its potential to perpetuate across cycles. But this same observation would also suggest that Republican bias, where observed, is more likely to be due to a more permanent geographic distribution of partisans, rather than more temporary considerations of legislators in anticipation of a single election cycle. This is further supported in Table 1 on p. 55 of the Jackman report. As mentioned above, of the 17 plans that Jackman claims are unambiguous as to sign throughout an entire decade, 16 are biased toward Republicans, and most of these 16 are not Republican gerrymanders.

D. Specific evidence from Wisconsin

We can see the overall trend toward Republican bias even without partisan intent specifically in the efficiency gap measurements in Wisconsin. From Figure 35 of the Jackman report, Wisconsin saw a larger negative efficiency gap in 2012 than any election in the last 40 years. However, this is just one of nine consecutive cycles of negative efficiency gaps, including seven cycles under two different bipartisan or court-drawn maps, gaps which with slight exceptions at the end of the 2000s, have grown steadily larger over two decades.

And the efficiency gap observed in the most recent 2014 cycle is not at all unusual for recent electoral history in Wisconsin. This is to be expected from geographical bias when tides shift strongly in favor of one party. Using a slightly different but analogous measure of bias, I find in two articles published in *Research and Politics* that average bias across several congressional maps drawn by Republicans declined from 19% to 9% between 2012 and 2014. This decline in bias under the somewhat stronger Republican tide in 2014 is echoed in Jackman's

efficiency gap measurements from Wisconsin, which declines from 14% to just under 9%. As mentioned above, the efficiency gap found is Wisconsin in 2014 is actually lower than the bias observed under the court drawn state legislative map in Wisconsin in two cycles of the previous decade: 2004 and 2006.

E. Analysis of Wisconsin Districts at the ward level

Even without regard to a specific district map, we can see the bias inherent in Wisconsin's geography at the ward level. Chen and Rodden posit that bias in several states comes out of a surplus of lean-Republican and safe Democratic pockets of population, compared to relative lack of lean-Democratic and safe Republican pockets. And mapping the distribution of Wisconsin wards confirms this exact pattern.

Based on the 2012 presidential election results, we can estimate what share of the two-party vote a Democrat would project to win in each ward in an election where each party won 50% of the statewide vote (data drawn from supplemental attachment to Mayer expert report). Since President Obama won 53.5% of the two-party statewide vote in 2012, this is most simply done by shifting each ward's actual Democratic vote share down by 3.5%. So a ward that voted 56% for Obama in 2012 would be estimated to vote 52.5% Democratic in an evenly balanced election. Figure 1 below shows the proportion of wards, as well as the share of statewide vote these wards comprise, at each level of Democratic support, demonstrating a clear geographic bias favoring lean-Republican wards.

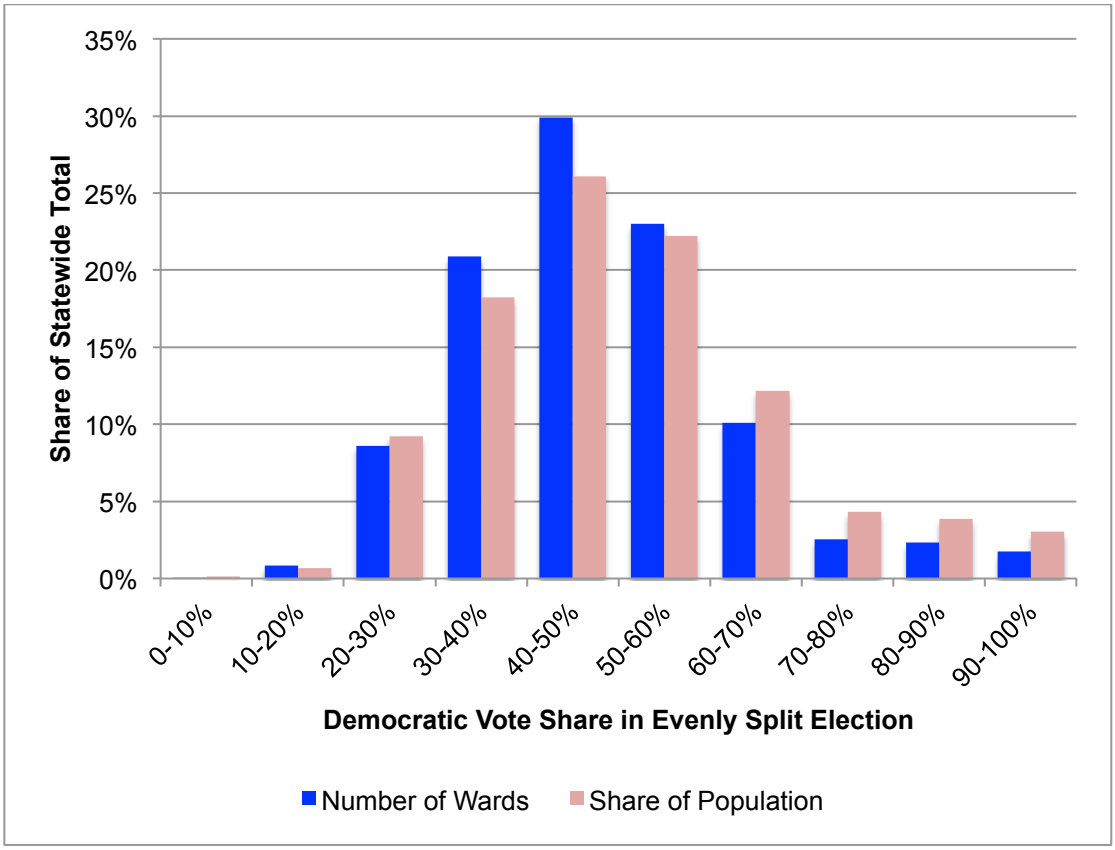

Figure 1. Wisconsin Ward Projections in Evenly Divided Statewide Election (Based on uniform swing from 2012 Presidential Election Results)

The number of wards in Figure 1 peaks at 40-50% Democratic vote, indicating the surplus of areas that marginally favor Republicans. At the same time, while there are virtually no wards voting overwhelmingly Republican there are several wards that vote overwhelmingly Democratic, and these wards are larger than most other wards in the state.

In an election evenly divided between the parties statewide, Republicans would win 60.2% of wards, comprising 54.4% of the voting population. In fact, a majority of all wards in the state (50.8% of wards, comprising 44.3% of voting population) would be won by Republicans with less than 70% of the vote. In contrast, less than a third of wards would be won by Democrats with less than 70% of the vote. Meanwhile, there are many more wards, comprising a much larger share of the population, that were extremely Democratic. In the evenly balanced election, 4% of wards, comprising 7% of voting population, would be won by

the Democrat with *more* 80% of the vote. Less than 1% of wards comprising less than 1% of population would be Republicans by a similarly huge margin.

Overall, it would appear that the recent results in Wisconsin are in line with both a national trend over the past two decades of greater natural Republican bias due to the increasing concentration of Democratic voters in compact urban areas. Republican control of the redistricting process does increase bias toward Republicans in election cycles where the vote share is close to even, but this is highly sensitive to very realistic shifts in the vote share, and should also be considered the context of geographic bias in the same direction.

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